APPENDIX A - DETAILED TASK DESCRIPTIONS, [redacted] IMAGERY INTERPRETATION RESEARCH CONTRACT, FY-1969, PHASE II

25X1

Task 6 - Precise Mensuration Study Support (Stereo Mensuration Accuracy)

[redacted]

Research on mensuration accuracy during past [redacted] contracts and during Phase I of the present contract has proven to be of valuable assistance to IEG/PHD in its attempt to assign objective accuracy statements to published linear dimensions. The present study will extend this successful work into the soon-operational realm of stereo mensuration. It supports an in-house IEG/PHD detailed study on precise mensuration. The stereo mensuration accuracy portion has two major objectives: To assess the relative accuracies of stereo vs. mono mensuration and to assign accuracy statements to PHD height measurements.

25X1 25X1

[redacted] contribution to this effort was scheduled to end during Phase I of the present contract, but data collection delays caused by in-house work load and priority considerations have forced postponement of the major portion of the task [redacted] to Phase II. During Phase I, an experimental plan was prepared which is now available for use by [redacted] personnel who will be conducting the actual testing in PHD. Approximately [redacted] of Task 6 funding was expended on this effort. The remainder will be applied to the analysis of the data collected by [redacted] and on final documentation of the study's results. In order to complete this task successfully before Phase II of the present contract ends, [redacted] will require the mensuration data for analysis no later than 1 May 1970. IEG/PHD is currently engaged in an effort to insure that this stipulation is met. (See pages 41-49, DK-400.)

25X1 25X1 25X1 25X1 25X1 25X1

Task 11 - Equipment Design Support (including TICOF Support) - [redacted]

25X1

Phase I efforts in the equipment design support area have materially aided both ESD and RED in evaluating equipment prototypes and recommending design improvements for production models. The first Advanced 918 Light Table, for example, was found to require redesign because the speed control knob for its motorized film drive was placed too close to the film edge and seriously endangered the operator's fingers. In addition, excessive resistance to easy winding was discovered in the manual film advance mechanism. Appropriate modifications have been recommended and are being implemented in the design of future 918 models.

Additional Phase I human engineering evaluation occurred for the Digitized Measuring Light Table, the Twin Stage On-Line PI Comparator, and the Advanced 1540 Light Table. A revision of standard specification

DB-1003, Operator Manual Requirements, was also completed, incorporating human factors principles aimed at increasing exploitation equipment/operator efficiency.

Human engineering evaluation of RED developed interpretation equipment will continue during Phase II as required. Specific candidates for such evaluation during Phase II will be the Image Comparison Microstereoscope, the [redacted] Prototype #2 1540 Advanced Light Tables, the Scan and Search PI Station, and the Model II Advanced Rhomboids. 25X1

In addition to this specific equipment development and evaluation support, Phase II will also include a pilot study of stereo mensuration pointing techniques. The results of this investigation will indicate to IEG/PHD whether or not it should be concerned about replacing the current method of pointing for stereo height measurements, which involves placing a floating dot on the perceived upper and lower limits of a target. Indications in the research literature are that greater accuracy may be attained through several alternative pointing methods.

Contrary to the DK-400 discussion, however, PHD participation in this first stereo pointing techniques study will not be required. Hardware, manpower and computer program requirements to conduct the study in-house are not feasible under PHD's heavy workload. Since this investigation will only be preliminary in nature, it will be accomplished elsewhere, probably at the US Geological Survey, with trained photogrammetrists using equipment as nearly similar to NPIC's as possible. Should this pilot program uncover findings of significant concern, PHD personnel would then be utilized to validate the results for NPIC application in a follow-on, in-house study.

Also included in Phase II under the Small Project Support subtask of Task 11 -- will be an investigation of IAS's request for the development of a special PI chair for use with direct viewing exploitation equipment. This study, not mentioned in DK-400, will define the specific, human engineering inadequacies of the currently-used, standard GSA office chairs and will recommend design improvements obtainable through either the development of a new chair or the purchase of an off-the-shelf model.

Task 11 will further include a Human Factors Consultation subtask not cited in DK-400. Support will be lent as appropriate to development efforts conducted by other NPIC contractors such as [redacted] (on Chip System Evaluation) and [redacted] (on Digital Image Manipulation). (See pages 70 - 75, DK-400). 25X1 25X1

Task 10 in DK-400, support for NPIC's Technology Integration and Checkout Facility (TICOF), will be incorporated in Task 11 during Phase II. [redacted] primary TICOF role will be to design operational evaluation test plans as required. Equipment candidates during Phase II for TICOF operational suitability testing will be the Twin Stage On-Line Comparator and the Image Comparison Microstereoscope (not mentioned in DK-400). The Wide Field, High Power Anamorphic Stereo Viewer discussed in DK-400 will not be available for evaluation due to contractual fabrication postponement. (See pages 66-69, DK-400).

25X1

Task 12 - Technology Research - Microscope Design Criteria (Field of View, Convergence Angle) [redacted]

25X1

Many Center personnel have suggested that a larger microscope field of view would aid PI's in their use of contextual image cues during identification and analysis of targets. To fulfill this anticipated requirement for an increased field of view, RED is currently developing the prototype Wide Field High Power Stereo Viewer. This instrument will be capable of rendering up to a 70° usable field of view for PI's. This size reflects current optics capabilities but not necessarily optimum PI performance. Objective specification of a maximum field for production models is required, however, since the technical difficulties and consequent costs of producing wide field of view optics increase rapidly as the field increases.

The Field of View Study discussed in DK-400 will be planned but not performed during Phase II since, due to a substantial delay in the delivery of the Wide Field High Power Anamorphic Stereo Viewer, no testing instrument for the study will be available until shortly after completion of the present contract. Simulation of the Wide Field optics has been considered, but judged virtually impossible given other critical requirements for the investigation. As a consequence, a thorough experimental design will be developed during Phase II so that the required study may be performed as soon after the Wide-Field Viewer's arrival as possible.

The study, when performed, will use NPIC interpreters and operational imagery to investigate whether or not an optimum microstereoscope field of view can be determined objectively. The study planning effort here will be aimed at the goal of establishing a rational limit to the field of view required for inclusion in future PI microstereoscopes. It will also be directed at evaluating objectively the validity of the prototype instrument. PI performance will be gauged by [redacted] Hunting and Reasoning Interpretation tests (developed under a previous contract), and the collected data analyzed to check any effects on PI performance efficiency attributable to different fields of view.

25X1

In addition to the above planning effort, Task 12 will continue the Convergence Angle Study begun in Phase I, an activity not mentioned in DK-400 under Phase II. Phase I's preliminary results showed that excessive microstereoscope convergence angles have a significant deleterious effect on some observers. This effect, a rapid fluctuation in the viewer's visual accommodation (focus) has been illustrated only with a small number of subjects and only through a physiological measure. A validation experiment using more subjects and employing a dynamic visual performance measure is now required to refine the data already collected. Furthermore, data for a $7\frac{1}{2}^{o}$ convergence angle (typical of the Zoom 240) should be added to the 15^{o} angle results obtained in the Phase I "worst case" study. Objective specification of optical design parameters for NPIC equipment continues to be an elusive goal for RED. The above Microscope Design Criteria Studies, however, will significantly advance this important objective. (See pages 76-79, DK-400).

Task 13 - Edge Identification Training (Pointing Accuracy Improvement) -

25X1 [redacted]

This task is based upon the demonstrated existence of mensuration performance deficiencies in inexperienced comparator operators. Both IEG/PHD and [redacted] have clearly identified these deficiencies through objective testing on operational imagery. A pointing accuracy improvement program is now required by IEG to promote the rapid achievement of operationally acceptable levels of mensuration performance by new personnel. This need is becoming ever more acute with the advent of interpreter mensuration.

25X1

Task 13's training product is planned to be equally applicable to PI's as well as photogrammetrists. Precise image edge identification and reticle placement are among the most critical human elements in the entire mensuration process. The training package to be developed here will promote standardization of operator pointing techniques and will help reduce the significant differences currently found among measurement personnel capabilities. It will extend an on-going IEG/PHD program for testing new photogrammetrists on comparator use with known-dimension operational imagery.

Pointing accuracy improvement training will be required of all future mensuration personnel whose performance is shown not to meet some minimally acceptable standard level to be established by PHD. Certification of an individual for operational mensuration activity will occur only after he has fulfilled such an accuracy requirement.

Contrary to DK-400, Task 13 will not involve heavy participation by IEG/PHD. Measurements to be used in the training will be drawn from the data collected in [redacted] 1968 mensuration study and Task 6 of the present

25X1

contract. Thus the collection of new data in PHD will be avoided. RED
25X1 will assist [redacted] in the assembly of operational materials for the training package. PHD's only direct involvement in this task will be through periodic consultation and through operational suitability evaluation of the final training package submitted.

25X1 [redacted] will be employed as a training technology consultant on this task. (See pages 80-86, DK-400).

Task 14 - Target Recognition Training for Area Specialists - [redacted] 25X1

A pilot training package is to be developed for the generalist interpretation function to include instruction on scanning techniques, but emphasizing instruction on the target knowledge required of generalists during their target identification activity. The task will be accomplished in direct response to the Phase I results obtained from Tasks 7 and 8, "Validation of Area Specialist Performance" and "Assessment of PI Target Knowledge" respectively. The results of these two studies have demonstrated to IEG that current generalist PI performance is clearly in need of improvement.

Task 7's objective was to demonstrate whether or not PI scanning ability improved from 1967 to 1969 in response to IEG's reorganization - emphasizing geographic area rather than target specialization among interpreters. The results of the Task 7 study indicated that some PI performance improvement occurred through the reorganization, but that acceptable search performance was still far from being achieved. The need for generalist training appeared evident.

Task 8's objective was to define the specific operational targets most frequently mis-identified by generalists. IEG has since prioritized the Task 8 target knowledge test results in terms of target importance. These rankings, along with a further analysis of Task 7's Hunt Test results for frequently-missed gross target signatures, will insure that an efficient training program is designed to reduce the Center's most pressing readout deficiencies. Such training is expected to promote consistent, high level performance among interpreters and will be designed to help correct individual as well as group deficiencies in target reporting by area specialists.

During the early stages of Task 14, IEG will choose 20-30 targets for training examples. Specific training content and methodology will be determined through discussions among Boeing scientists, IEG, RED, NPIC

Training Branch, and Offutt PI Course personnel. [redacted] will be a special training technology consultant to [redacted] on this task. [redacted] will also participate in the final training package development. (See pages 87-91, DK-400).

25X1
25X1
25X1
25X1

Task 15 - State-of-the-Art Studies - [redacted]

25X1

Phase I efforts in the state-of-the art area have resulted in such products as special literature reviews of research on line-scan imagery exploitation and real-time imagery transmission. These documents will aid NPIC in planning for future acquisition system exploitation requirements. Phase I also included updating of the Human Engineering Design Guide with new sections on the acoustical environment and on mensuration comparator design. This document continues to be an invaluable source of compiled design data for use by imagery exploitation equipment developers throughout the Intelligence Community.

Monitoring of past and current developments in the field of imagery interpretation research will continue in Phase II, although at a decreasing level of effort since a firm data base of information has already been assembled. Evaluation will be made of non NPIC-sponsored research results for their relevance to Center requirements. Special attention will be paid to unconventional imagery interpretation techniques as well as to electronic collateral display advances. Moreover, a specific literature search will be conducted on unaided stereoscopic displays, a topic not spelled out in DK-400, but one of growing NPIC concern, as the need increases for PI stereo viewing in an unencumbered, rear or front projection mode. Finally, the Human Engineering Design Guide will be revised and updated based upon any newly available information. (See pages 92-95, DK-400).